

# PATENT SPECIFICATION

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(72) Inventor GÜNTHER HAUENSTEIN

(19)



## (54) CONVEYOR MEANS FOR TEMPORARY STORAGE OF SHEETS OF PAPER, SUCH AS BANK NOTES

(71) We, LANDIS & GYR GMBH, a body corporate organised and existing under the laws of the Federal Republic of Germany, of D-6 Frankfurt/Main 60, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to conveyor means for temporary storage of sheets of paper of different sizes, such as bank notes.

In self-service machines which have to collect quite large amounts of money, for example machines selling travel tickets or petrol, it must be possible for bank notes or vouchers which have been inserted and found to be in order to be kept in an intermediate store, either until the total amount payable has been inserted or until premature return of the money is required, either at the customer's wish or because a second or further bank note is not assessed as satisfactory. The intermediate store has to store already-inserted notes until this decision is taken, so that it can then either return or finally collect them.

According to the present invention there is provided conveyor means for temporarily storing sheets of paper of different dimensions, for example bank notes, the storage means comprising an inlet aperture, formed between a first endless belt and a first roller, to receive a sheet of paper to be stored, and an adjoining intake section bounded by the first endless belt and a guide said intake section leading of a first point where a second roller changes the direction of the first endless belt, and to a first contact section between the first endless belt and a second endless belt; a third roller adjacent to the second roller between said intake section and said first contact section but on the opposite side of said guide; said third roller changing the direction of a third endless belt which belt

forms a second contact section between the third endless belt and the second endless belt; a motor for driving the first, second and third endless belts to transport the sheets of paper, gripped between the appropriate endless belts which are pressed resiliently against one another over their whole sheet-engaging length to between the first and second endless belts when rotated in one direction and thereafter to between the second and third endless belts when rotated in the other direction; and an indicating means at each end of the first and second contact sections for detecting the arrival of sheets of paper.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal section through a conveyor means for bank notes; and

Figure 2 is a detail relating to the arrangement of a guide.

In Figure 1 an unspecified testing apparatus for testing bank notes is shown at 1. Adjoining the outlet rollers 1a of testing apparatus 1 is a feed passage 1b which leads a sheet of paper emerging from apparatus 1, which will hereinafter simply be referred to as a bank note, to an inlet aperture 2 and onto an intake section 3 of a conveyor device. The functional groups of the conveyor device are fitted between two parallel sheet members 4, of which only one is visible in the sectional drawing. A first endless belt 5 forms an upper limit to intake section 3 between two direction-changing rollers 6 and 7. The other, lower limit to intake section 3 comprises a sheet metal guide 8. The end of the guide 8 near inlet aperture 2 carries a rotatably mounted roller 9 which projects slightly above the surface of the guide 8 facing towards endless belt 5. The other end 10 of the guide 8 is mounted so that the guide 8 can pivot between two end positions.

In one end position, the rest position, guide 8 adopts the position shown in the

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drawings, forming a relatively large inlet aperture 2 between first endless belt 5 and roller 9.

5 An optical sensor 11a for indicating the end of a bank note passing through may be arranged at a point A immediately after the outlet rollers 1a of the apparatus 1 for testing the bank notes.

10 Instead of means to indicate the end of the bank note, an optical sensor 11 for indicating the beginning of an arriving bank note may be arranged shortly after roller 9, in the direction of travel of the bank note. The distance between sensor 11 and point A is a little shorter than a length  $e_{min}$  corresponding to the shortest bank note.

20 In the second end position, that is to say its operative position, guide 8 lies parallel with and only a short distance away from the part of endless belt 5 forming intake section 3, as indicated in broken lines in Figure 2. As can be seen from Figure 2, this position is reached by means of an electromagnet 13 which engages the fulcrum at end 10 of guide 8 by means of a lever 12, against the force of a spring 14.

25 As can be seen from Figure 2, guide 8 has at least one non-return mechanism at the end of intake section 3. This is in the form of a flap 15 which is mounted outside its centre of gravity on guide 8 for easy rotation. The position of the centre of gravity is such that the flap 15 bears on a stationary stop (not shown) and, in the rest position, is always held in a horizontal position in respect of Figure 2.

30 Adjoining direction-changing roller 7, first endless belt 5 forms a contact section 16 with a second endless belt 17 (Figure 1).

40 Near direction-changing roller 7, between intake section 3 and contact section 16 but on the opposite side of guide 8, a further direction-changing roller 18 is provided. This is associated with a third endless belt 19 which, together with second endless belt 17, forms a second contact section 20. In this example each of the contact sections 16 and 20 is straight, but they might equally well be of any other geometrical shape. The contact sections 16 and 20 can thus to a great extent be adapted to the dimensions found in vending machines.

55 As can be seen from Figure 1, the path of each of the three endless belts 5, 17 and 19 is closed by other, unspecified rollers. One roller per endless belt is guided in longitudinal bearings and biased by a spring so that the endless belts 5, 17 and 19 are always taut. The geometrical arrangement of the rollers, together with this resilient mounting of each roller, causes the endless belts 5, 17 and 19 to be applied to one another with a slight bias at contact sections 16 and 20.

The arrangement further comprises a motor (not shown) with a mechanism for jointly driving the three endless belts 5, 17 and 19.

70 At the ends 21 and 22 of the two contact sections 16 and 20 there is an outlet passage 23 and 24 respectively, each with an indicating means to detect the arrival of bank notes. In the example described these are optical sensors 25 and 26 respectively. 75

Outlet passage 23 leads to a return slot and outlet passage 24 conveys the bank notes into a till.

80 Each of the three separate endless belts 5, 17 and 19 comprises two adjacent single belts kept at a constant spacing from each other. Each separate belt could equally consist of only one single belt or be made up of a plurality of adjacent single belts a certain distance away from one another. In order to guide the bank notes to or from the belts 5, 17 and 19 the appropriate guide means enter the space between and adjacent to the individual belts. In this way guide 8 (Figure 1) extends through endless belt 17 and flap 15 (Figure 2) through endless belt 5. 85 90

The following sections of path have been defined in Figure 1 in order to clarify the mode of operation which will be described below: 95

Distances  $e_{min}$  and  $e_{max}$  correspond to the lengths of the shortest and longest acceptable bank notes respectively. They are shown starting from point A. The distance between point A and a point B in intake section 3 is equal to the length  $e_{max}$  of the longest bank note. A distance  $f$  in intake section 3 between point B and point C at the beginning of contact section 16 between the two endless belts 5 and 17 is equal to a distance  $f'$  between point C and a further point D on the second contact section 20. A distance  $g$  along first contact section 16, extending from point C to sensor 25 in outlet passage 23, is longer than the length  $e_{max}$  of the longest bank note to be stored. A distance  $h$  from point D on the second contact section 20 to sensor 26 at outlet passage 24 is equal to the sum of the length  $e_{max}$  of the longest bank note and an amount  $X$  by which the distance  $g$  is greater than  $e_{max}$ . 100 105 110 115

The arrangement described operates as follows. A bank note inserted in the vending machine first passes through the testing apparatus 1. This, together with the control portion of the vending machine, decides what is to happen to the bank note in the conveyor device and gives the necessary control orders. 120 125

From outlet rollers 1a of testing apparatus 1 the bank note is pushed along feed passage 1b and through inlet aperture 2 to intake section 3. The arrival of a bank 130

note in intake section 3 is sensed by optical sensor 11 or 11a, according to the construction of the latter, and causes electromagnet 13 to be energised. Guide 8 is applied to first endless belt 5 and grips the bank note between belt 5 and roller 9. Shortly afterwards endless belts 5, 17 and 19 are driven in the same note-conveying direction, causing the bank note to travel on in the direction in which it entered, that is along section *f*. It pushes flap 15 (Figure 2) out of its horizontal position and is inserted in contact section 16, that is between endless belts 5 and 17. Such insertion is ensured by making the direction-changing angle between intake section 3 and contact section 16 between the first and second endless belts less than 90° and preferably about 60°. The bank note passes through contact section 16 until it is picked up at the end 21 by the light beam of optical sensor 25. If no storing or collecting order has been issued, the bank note moves on and is ejected through outlet passage 23 and a return slot.

If on the other hand storage or collection is required, sensor 25 will firstly cause the running direction of the motor to be reversed and secondly cause magnets 13 to be de-energised and guide 8 to move into the rest position, with flap 15 reassuming the horizontal position shown in Figure 2. The bank note leaves contact section 16 at roller 7, and flap 15 guides it to the second contact section 20 through which it passes to sensor 26. If an order for final collection has already been issued the motor will continue to run and the bank note will drop into the till. If on the other hand storage has been ordered, sensor 26 will stop the motor, making the apparatus ready to receive a further bank note. The bank note already stored now lies along section *h* with one end at sensor 26. Even if it is a bank note of the largest allowable length  $e_{max}$ , its other end will be a distance *X* to the right of point D (relative to Figure 1). It is assumed that the second bank note inserted is also of the length  $e_{max}$ . As soon as the second note switches on the drive for endless belts 5, 17, 19 in the same way as the first, a first bank note, lying in second contact section 20, will move towards contact point C simultaneously with the second note, along equal distances *f* and *f'* respectively, and the notes will be superimposed in contact section 16.

Since if the sensor 11a initiates feed, the second bank note only has to cover distance *f* in order to reach point C, whereas the first bank note has to cover the distance *f*+*X*, the two notes do not arrive at point C simultaneously. The first note inserted is therefore always a distance *X* behind the subsequently inserted note. For

this reason the second note is the first to reach sensor 25. Provided that no returning order has been received in the meantime, sensor 25 will reverse the rotary direction of the drive motor. To ensure that in this position the right end (still relative to Figure 1) of the first bank note has definitely left section *f*, and flap 15 can reassume its horizontal position, the length of section *g* along first contact section 16 must be at least  $e_{max}+X$ . It can readily be made longer than this if so required by the location of outlet passage 23.

The bank notes now move back to the right into second contact section 20 for possible receipt of further bank notes. The first note inserted which is a distance *X* ahead of the others, is always responsible for giving the signal at sensor 26. This has been found advisable because such small changes in the relative position of the notes have no effect on the initial position for starting the motor. A length of about 20 mm has been found suitable for distance *X*.

The size of sections *f* and *f'* ensures that bank notes already stored in second contact section 20 cannot obstruct flap 15.

Bank notes already stored in second contact section 20 can be either returned or passed into the till at any time. For this purpose the motor can be started in either direction of rotation, until the appropriate sensor 25 or 26 indicates the end of the passage of the bank notes and turns off the motor.

#### WHAT WE CLAIM IS:—

1. Conveyor means for temporarily storing sheets of paper of different dimensions, for example bank notes, the storage means comprising an inlet aperture, formed between a first endless belt and a first roller, to receive a sheet of paper to be stored, and an adjoining intake section bounded by the first endless belt and a guide; said intake section leading to a first point where a second roller changes the direction of the first endless belt, and to a first contact section between the first endless belt and a second endless belt; a third roller adjacent to the second roller between said intake section and said first contact section but on the opposite side of said guide; said third roller changing the direction of a third endless belt which belt forms a second contact section between the third endless belt and the second endless belt; a motor for driving the first, second and third endless belts to transport the sheets of paper, gripped between the appropriate endless belts which are pressed resiliently against one another over their whole sheet-engaging length to between the first and second endless belts when rotated in one direction and thereafter to between

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the second and third endless belts when rotated in the other direction; and an indicating means at each end of the first and second contact sections for detecting the arrival of sheets of paper.

2. Conveyor means according to Claim 1 wherein said guide carries said first roller at the end nearer said inlet aperture, and is mounted at its other end for pivoting movement between two end positions, so that in its operating position said guide comes to lie parallel with and a short distance away from the part of the first endless belt forming said intake section.

3. Conveyor means according to Claim 2 wherein said guide has at least one non-return mechanism at the end of said intake section to prevent return of a sheet of paper to said inlet aperture.

4. Conveyor means according to Claim 1, Claim 2 or Claim 3 wherein the direction-changing angle between said intake section and said first contact section is less than 90°.

5. Conveyor means according to any one of the preceding Claims wherein the first and second contact sections lie approximately on a straight line.

6. Conveyor means according to any one of the preceding Claims wherein each individual endless belt comprises a plurality of adjacent single belts at a spacing from one another.

7. Conveyor means according to any one of the preceding Claims associated with bank note testing apparatus and wherein a first sensing means, arranged at a second point immediately after outlet rollers of said apparatus, is provided to indicate the trailing end of a bank note passing through.

8. Conveyor means associated with bank

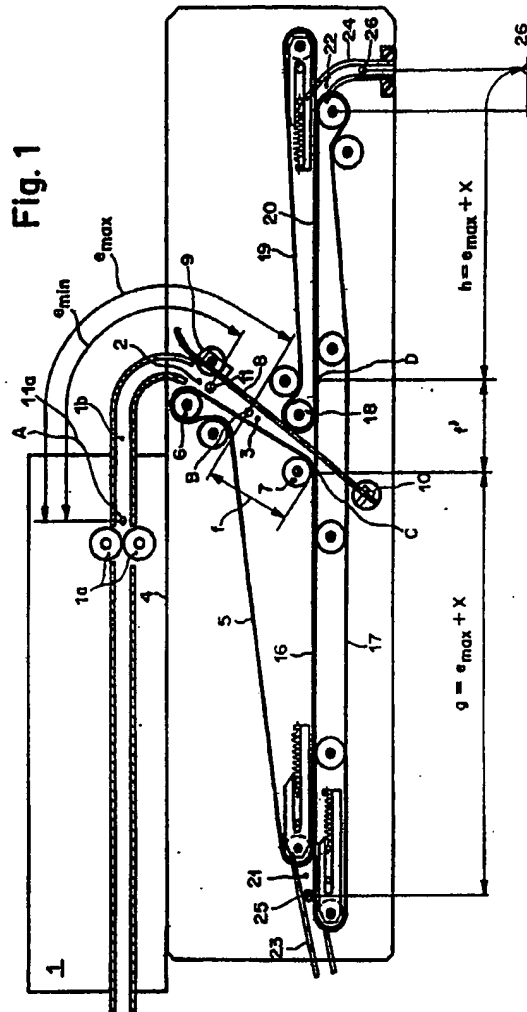
note testing apparatus and according to Claim 7, wherein a second sensing means for indicating the leading end of an incoming bank note is arranged shortly after the first roller, in the direction of movement of the bank note, at said inlet aperture, and the distance between said second sensing means and said second point is shorter than the length of the shortest bank note to be stored.

9. Conveyor means associated with bank note testing apparatus and according to Claim 7 or Claim 8, wherein the distance between said second point and a third point in said intake section is equal to the length of the longest bank note to be stored; the distance in said intake section between said third and first points is equal to the distance between said first point and a fourth point on said second contact section; the distance along the first contact section from said first point to a sensor in an outlet passage is longer by a distance X than the length of the longest bank note to be stored; and the distance from said fourth point to a sensor in an outlet passage along said second contact section is equal to the sum of the length of the longest bank note to be stored and said distance X.

10. Conveyor means according to any one of the preceding Claims mounted between two parallel sheet members.

11. Conveyor means substantially as described with reference to the accompanying drawings.

For the Applicants,  
D. YOUNG & CO.,  
Chartered Patent Agents,  
9 and 10 Staple Inn,  
London, WC1V 7RD.



1510934 COMPLETE SPECIFICATION

**2 SHEETS**

This drawing is a reproduction of  
the Original on a reduced scale  
Sheet 2

**Sheet 2**

**Fig. 2**

